Growing population segments and their impact on future transport

Haustein, Sonja; Nielsen, Thomas Alexander Sick; Siren, Anu Kristiina

Published in:
Danish Journal of Transportation Research - Dansk tidskrift for transportforskning

Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

Denne artikel er publiceret i det elektroniske tidsskrift
Artikler fra Trafikdage på Aalborg Universitet
(Proceedings from the Annual Transport Conference at Aalborg University)
ISSN 1603-9696
www.trafikdage.dk/artikelarkiv

Growing population segments and their impact on future transport

Sonja Haustein, Department of Transport, Technical University of Denmark, Bygningstorvet 115, 2800 Kgs. Lyngby, Denmark, sonh@transport.dtu.dk

Thomas Alexander Sick Nielsen, Department of Transport, Technical University of Denmark, Bygningstorvet 116B, 2800 Kgs. Lyngby, Denmark, thnie@transport.dtu.dk

Anu Siren, The Danish National Centre for Social Research, Herluf Trolles Gade 11, 1052 Copenhagen, Denmark, anu@sfi.dk

Abstract

The European population is facing enormous demographic changes. Based on data from the Danish National Travel Survey (NTS), this paper focuses on three major societal trends – changing family structures, ageing, and urbanisation – and the impact of these trends on future car use in Denmark. We compared the mode choice of single parents and people in single person households (both in "family age" and after retirement) with the choice of people in more traditional household forms. Additionally, we looked into differences within these groups related to gender and urban from. The relevance of these variables for car use as driver, as passenger, and in total was estimated in linear regression analyses. Persons living alone showed the lowest car use; living with a partner and having kids increased driving. While gender differences in older people's car use could partly be explained with women's lower car availability and driving licence rates, this was not the case for younger people. Thus, gender roles and different travel preferences are expected to play a role here. Living in a large urban area significantly decreased car use of younger people, whereas it increased older people's car use as passenger. The lower driving rates of singles and single parents compared to couples with children could be explained with differences in car availability. When this was controlled for, single parents used the car as often as couples with children. To what extent the mobility needs of single parents are met satisfactorily without a car and whether they could serve as a model for car-free living are among the questions that cannot be answered based on the NTS data but should be addressed in future research.

1 Background

European societies are facing enormous demographic changes: the population is ageing, becoming more ethnically diverse and is further characterised by changing family structures. In addition, in future even more people are expected to live in urban areas. This paper focuses on three of these major trends – changing family structures, ageing, and urbanisation – and the impact of these trends on future mobility patterns in Denmark.

Major Societal Trends

Since the middle of the 60's we can notice a structural change in family forms in Denmark as well as in other European countries. While the middle-class ideal of the traditional family consisting of married parents and their own children looses importance, we find an increase in alternative family forms, such as patchwork families, unmarried and same-sex partnerships, and single parent families. Today, every second 16-year old child in Copenhagen does not live together with both biological parents (Danmarks Statistik, 2013).
In addition, the population is ageing rapidly in all industrialised countries. In Denmark, the proportion of people aged 65 and older is growing steadily and is expected to be around 24% of the total population in 2040 (Danmarks Statistik, 2011). The ageing population is increasingly diverse with regard to age, socio economy, health, and household structure (cf. Haustein et al., 2012; Siren & Haustein, 2013). In addition, the majority of the older population is female. The percentage of women rises with age to above 60 percent for those aged 80 and over. While we find an overall increase of single-person households in Denmark, this trend is especially marked for older women.
Furthermore, current growth patterns and population forecasts point towards an urbanisation trend that increasingly favours the largest cities and metropolitan regions. Mainly the urban regions with the largest cities: Greater Copenhagen and East Jutland are expected to have population growth between 2012 and 2050, so that an increasing share of the future population will live in large urban areas (Danmarks Statistik, 2012).

Travel patterns in different household forms and urban settings

Household and family form have been found to be related to mobility parameters. Single parents, for example, show greater multi-modal behaviour compared to families with two parents, spend more time outside the home and are found to prefer urban environments (Chlond & Ottmann, 2007). Persons living alone show a higher level of mobility, however, more oriented towards the closer neighbourhood and less focused on the car (Haustein, 2006; Kunert, 1994). In case of living in a single household it makes a significant difference if one has a partner outside the household or not as persons in "living-apart-together" relationships have been found to be more mobile (Haustein, 2006).
For older people the effect of living in a single household seem to be more controversial. When looking at descriptive data, living in a single household is associated with lower car access, lower satisfaction with mobility options and a lower level of realised mobility for older people (e.g. INFAS & DLR, 2010; Siren & Hakamies-Blomqvist, 2004). However, a part of these differences can probably be explained by age and gender effects as the older old and women are overrepresented in single-person households. Actually, studies based on multivariate analyses challenge the assumed mobility-reducing effect of living in a single household showing that older people's leisure activities (Haustein, 2012) or general mobility (Evans, 2001; Scheiner, 2006; Schwanen et al., 2001) increases with decreasing household size when other factors, such as age, gender, and car availability are controlled for. A possible explanation for this is that older people living alone are forced to satisfy their needs for social contact outside the home (cf. Scheiner, 2006; Schwanen et al., 2001). Without the ability to drive a car, older people are more likely to have mobility wishes that remain unfulfilled – even when controlling for relevant background variables, such as age, health, and gender (Hjorthol, 2013; Siren & Haustein, 2014a).

The current trend of urbanisation can be evaluated positively in terms of reaching car-reduction goals as people in urban areas travel shorter distances and use the car less often compared to rural residents (e.g. INFAS & DLR, 2010). Congestion, pollution and noise, however, remain main challenges in urban areas of high density. In addition, the urban sprawl and the withdrawal of public transportation in rural areas increase car dependency (cf. Ahern & Hine, 2012; Eriksson & Westlin, 2003) and raises questions of equity. Finally, recent findings point to urbanisation being less effective in affecting older adults' travel patterns – suggesting a need for further elaboration of joint outcomes of ageing and urbanisation trends (Figueroa et al., 2014).
As a contribution to the interpretation of trends and their effects we look into the car use of two selected growing population segments in Denmark: persons in single households (in different life stages) and single parents. We compare the mode choice of people in these living arrangements with the choices of people in more tradition forms of living and look into differences within these groups related to gender and urban from.

2 METHOD

Data

This study is based on data from the Danish National Travel Survey (NTS). In the NTS, a representative sample of the population (aged 10–84 years) is drawn and interviewed each year regarding their travel activities during the previous day (Christiansen, 2012). Respondents are advised by mail and given the possibility to respond online, however, 80% of the interviews are computer assisted telephone interviews (CATI). The interviews are carried out throughout the year to account for time-related variations in travel patterns. The survey collects data on daily travel activities including trip stages, trips, journeys (trip-chains) and the related travel purposes. Moreover, it contains details on household cars, household type and composition, income, age, gender, education, employment, occupation, type of residence, homeownership, driving licences, and disability (Christiansen & Haunstrup, 2011).
The Danish NTS includes interviews with approximately 10,000 randomly drawn persons each year. The present study uses the full dataset collected between 2007 and 2012 with a total of 109,583 respondents.

Analysis

Based on NTS data, the travel mode choice of persons in single households and single parents was compared with the choice of persons in couple households with and without kids. Only people within an age range from 25 to 55 were included to create comparable groups within the typical "family phase". The mode choice of persons in single vs. couple household was additionally considered for people in retirement age (65-84). Thus, all in all six groups were compared:

- people aged 25-55 in single person households (1)
- people aged 25-55 in single parent households (2)
- people aged 25-55 in couple households without kids (3)
- people aged 25-55 in couple households with kids (4)
- people aged 65-84 in single person households (5)
- people aged 65-84 in couple households (6)

These groups were further split by gender and urban form. We distinguished between people living in rural areas (= cities with less than 1000 inhabitants) and large urban areas (= more than 70,000 inhabitants = five biggest cities in Denmark). The data were weighted on the basis of date, gender, age, and location to adjust for potential sample selection bias.
In addition to the descriptive analyses, linear regression analyses were conducted to estimated the effects of belonging to a specific household segment, urban from, and gender on the percentage of trips by car (as

driver, passenger, in total) when controlling for relevant background variables. The analyses were done separately for people in the family phase and in retirement age.

3 RESULTS

Descriptive results

In the following, the percentage of trips conducted by different transport modes (modal split) is presented for the six different household segments and then further split by gender and urban form. As Figures 1 shows, the overall car use increases with household size, while the percentage of trips as driver is highest for the household types with children and the percentage as passenger is higher when people live together with the partner, who can serve as an alternative driver. Persons in single households in both age groups use alternative transport modes more often – the younger cycle more whereas the older walk more often. Couples without kids transport themselves also quite similar in both age groups. All in all, age differences are less pronounced than differences by family form.

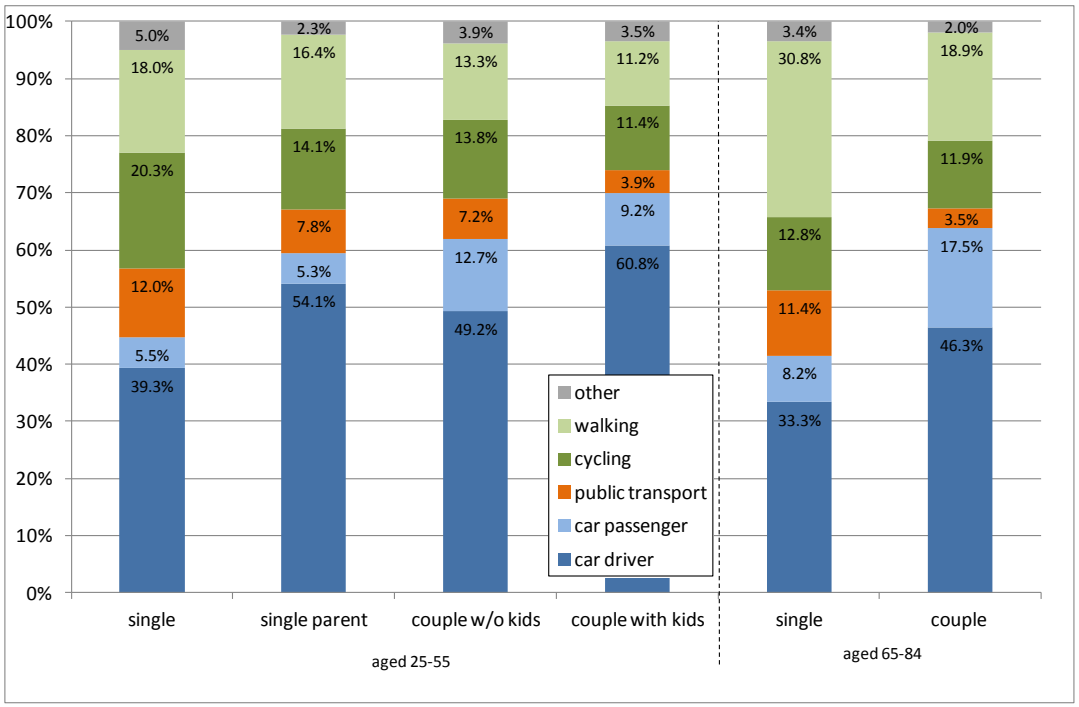

Figure 1: Modal split by household form and age group

Gender differences

As Figure 2 shows, women are in all household forms less likely to drive a car compared to men and more likely to be passenger and use alternative transport modes to the car.

For older people (see Figure 3) gender differences related to driver/passenger rates are even more pronounced. Here one has, however, to take into account that a greater share of women are not licensed as drivers. Apart from the different share in being driver or passenger, older couples do not differ that pronounced in their mode choice, while older singles do. Women in a single household use public transport and walk much more often than man, probably as many of them lack a licence and/or a driver.

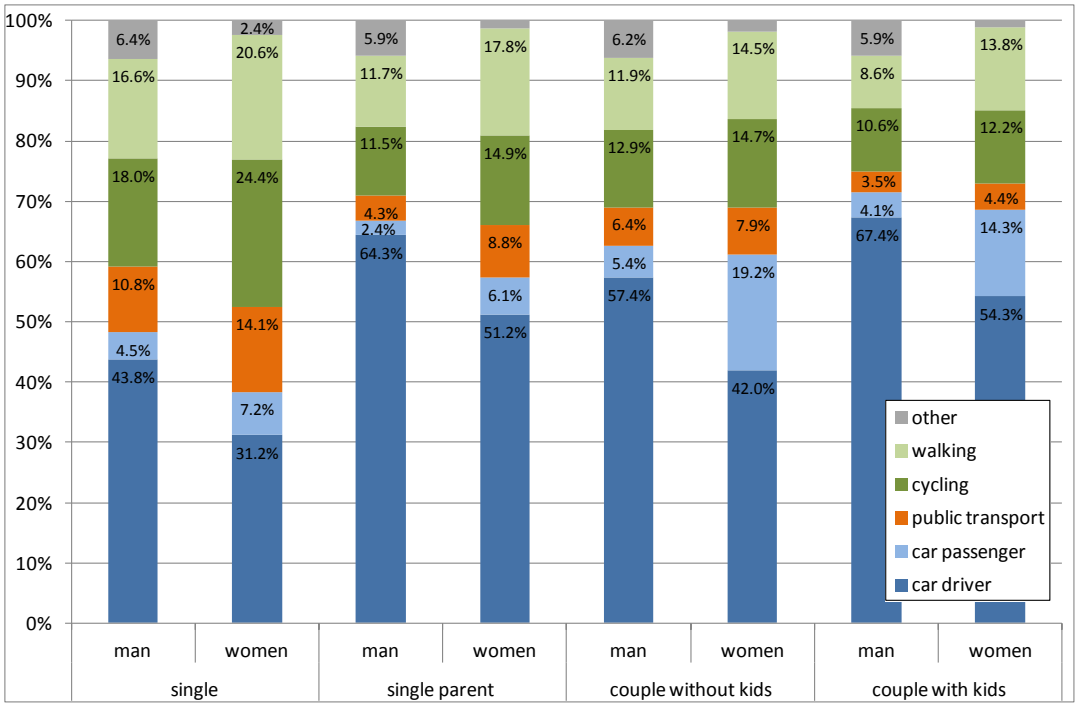

Figure 2: Modal split by household form and gender (family phase)

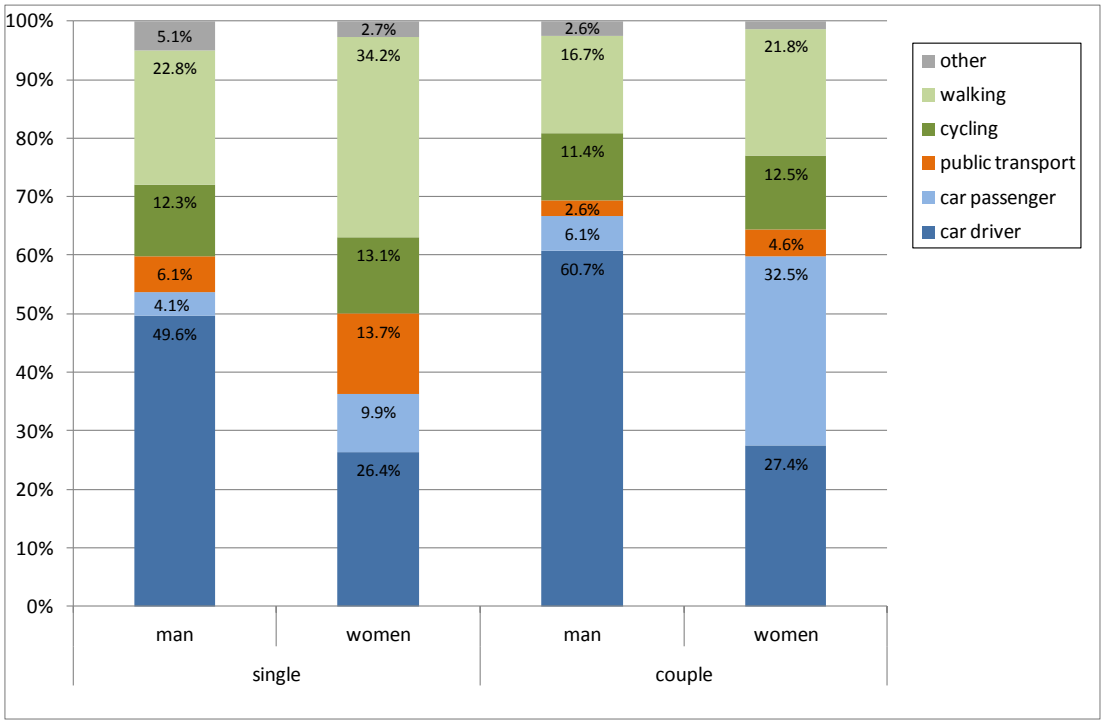

Figure 3: Modal split by household form and gender (older people)

Urban form

As Figure 4 shows, the percentage of car use is in all rural household forms in the family phase over 70%, indicating that people in rural areas are highly dependent on the car for daily transport. By contrast, large urban areas offer better possibilities for the use of alternative transport modes and thus we find a greater variation depending on the household from, which basically reflects the results for the whole population just on a lower level of car use: highest car use for couples with kids, lowest for persons in single households.

For older people (Figure 5) both, living with a partner and urban from play as relevant role for car use, public transport use, and walking, while the share of cycling mainly depends on urban from (more cycling in urban areas). The car is used for more than 50% of trips by people in rural areas and couples in urban areas, while for older people in single households in urban areas walking is by far the most important transport mode. For couples in rural areas public transport plays no role at all, indicating that it is not a good alternative to the car and probably only chosen if no alternative is available, which might be especially a problem for older women in rural areas, who live in single households.

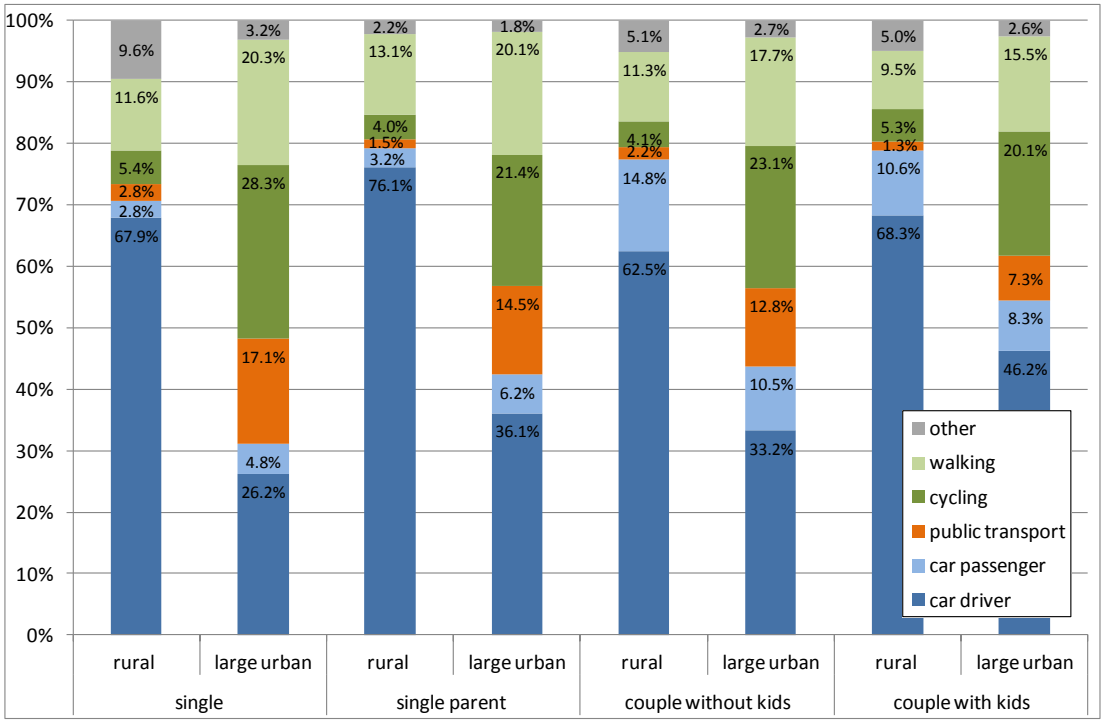

Figure 4: Modal split by household form and urban from (family phase)

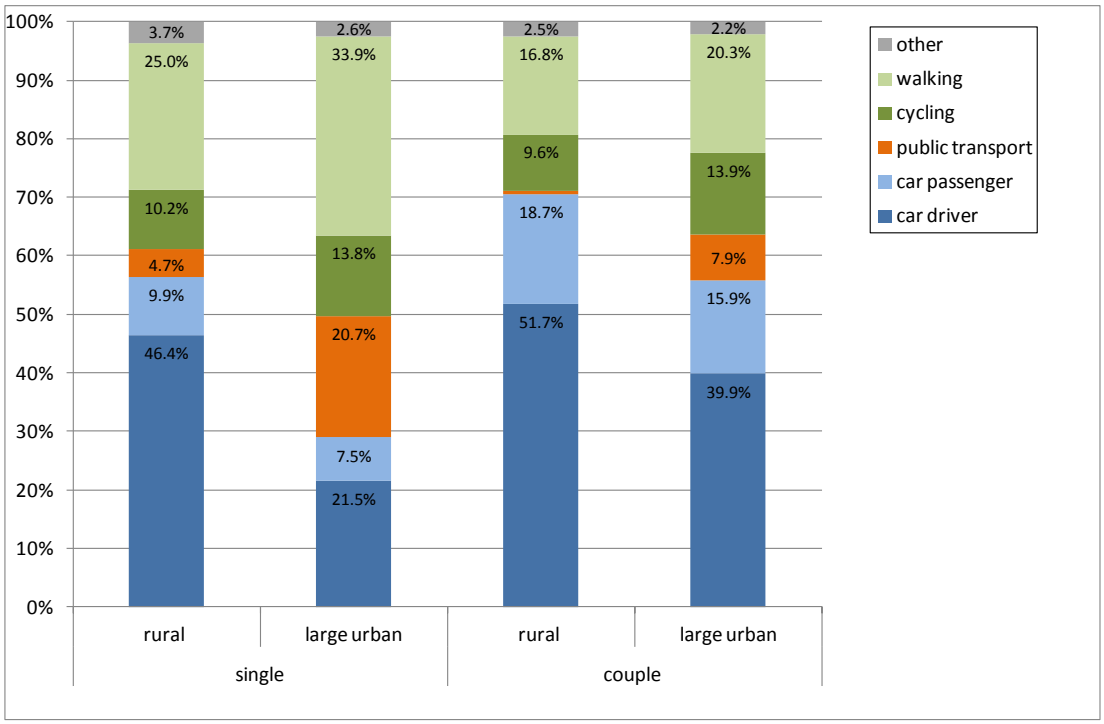

Figure 5: Modal split by household form and urban from (older people)

Multivariate results

We conducted linear regression analyses to examine whether the household form had a significant effect on car use, when relevant background variables were controlled for. In addition, we focussed on the effects of gender and urban form. As dependent variables we used the percentage of trips conducted by car as a driver (as main transport mode on a trip), car as passenger, and car in total. While we included demographics and spatial variables in the first step (Model 1), we entered car availability in a second step, to examine if differences found in relation to gender, urban and household form either remained significant or could be explained with differences in car availability (Model 2). In case of older people we also controlled for having a driving licence in the second step. We did all analyses separately for persons in the family phase (25-55 years) and older persons (65-84 years).

Car use as driver

Table 1 shows the regression results for the percentage of trips conducted by car as driver.

Table 1: Linear regression analyses: Car use as driver

Car as driver (% of trips)	**Young (25-55)**				**Old (65-84)**			
	Model 1		**Model 2**		**Model 1**		**Model 2**	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
Age	.044	***	-.011	*	-.048	***	.042	***
Female	-.140	***	-.137	***	-.321	***	-.240	***
Handicaped	-.016	**	-.010		-.097	***	.004	
Unemployed/retired	-.074	***	-.031	***	-.061	***	-.054	***
Household income	.021	***	.010	*	.002		-.010	
Single household	-.045	***	.056	***	-.015		.108	***
Single parent	.045	***	.078	***				
Couple with kids	.105	***	.049	***				
Large urban	-.170	***	-.093	***	-.061	***	-.018	*
Rural	.032	***	.025	***	.041	***	.034	***
Distance to nearest station	.082	***	.056	***	.048	***	.027	**
Car(s) in household			.397	***			.291	***
Driving licence							.212	***
R^2	.109		.225		.153		.297	
adjusted R^2	.108		.225		.153		.296	

Before including car availability, living in a large urban area and female gender have the strongest effects, both significantly deceasing the likelihood of driving a car, while living in a family with children increases car use as driver. The other included variables are also significant but have minor effects. When controlling for car availability, this variable has by far the strongest impact. It is, however, interesting to see how the effect of the household form variables change. While living in a single household was related to having a lower share of car trips before, it is now the other way round, indicating that those singles, who have a car in the household, drive as much as couples with kids (while persons in couple households are in addition more often passenger). Similarly, being single parent has a stronger positive effect on car use, when car availability is controlled for. With inclusion of car availability, the effects of household income and age decrease – indicating that both variables are related to car availability. Gender, on the other hand, remains a strong predictor, indicating that it is not because of differences in car availability women drive less but probably due to different gender roles determining who is sitting on the driver seat and/or different transport preferences.

In the case of older people we find similar effects. However, while age increases the car use of young people (due to its relation to car availability), for older people increasing age is related to a decreasing percentage of trips by car as driver. However, when car availability is controlled for, the direction of influence changes, that means for older people who still have a car in the household, the older old use the car for a higher share of their trips than the younger old. Probably the car serves as a compensatory aid for these older people who might have problems with the use of alternative transport modes due to physical limitations and thus do most of their trips by car. For gender and living in a single person household we find similar effects for the old as for the young: women drive less, even when car availability and licence status are controlled for and living in a single household increase the percentage of driving when car availability is controlled for.

Car use as passenger

For people in the family phase driving as a passenger is most strongly related to female gender (see Table 2). No other factors have relevant effects and all in all, not much variance of car use as passenger can be explained for people in the family phase; also the inclusion of car availability has no relevant effect.

Table 2: Linear regression analyses: Car use as passenger

Car as passenger	**Young (25-55)**				**Old (65-84)**			
(% of trips)	**Model 1**		**Model 2**		**Model 1**		**Model 2**	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
Age	-.011	*	-.013	*	.036	***	-.012	
Female	.192	***	.192	***	.082	***	.042	***
Handicaped	.039	***	.039	***	.017		-.042	***
Unemployed/retired	.028	***	.029	***	-.011		-.016	
Household income	-.004		-.005		-.006		.003	
Single household	-.073	***	-.070	***	.122	***	.015	
Single parent	-.084	***	-.083	***				
Couple with kids	-.056	***	-.058	***				
Large urban	-.031	***	-.028	***	.148	***	.116	***
Rural	.000		.000		-.003		.003	
Distance to nearest station	.002		.001		-.057	***	-.042	***
Car(s) in household			.012	*			-.285	***
Driving licence							-.041	**
R^2	.049		.049		.119		.139	
adjusted R^2	.048		.048		.118		.138	

For older people we find a strong relation to living in a large urban area. A part of this can be explained by the lower car availability of older people in large urban areas, which make them more dependent on being driven by others for destinations that are difficult for them to reach by alternative modes. However, the effect of urbanity remains significant when car availability is controlled for, which may reflect that older people in urban areas more often have a driver available outside the own household and a greater tendency for car pooling. For older people the gender effect clearly decreases when car availability and licence ownership is controlled for, reflecting the lower licence rates of older women. The effect of living in a single household is clearly linked to car ownership and loses its significance when car availability is controlled for.

Car use in total

When looking at car use in total (Table 3), living in a large urban area has by far the strongest car use reducing effect for people in the family phase. Even when controlling for car availability it is still the strongest factor. By contrast, household form mainly has an effect through its association with car availability as the different effects in Model 1 and 2 show. Single parents with a car use it at least as often as car owning couples.
For older people's car use it is less important where they live but whether they live together with a partner, which is again associated with higher car ownership. For car use in total, gender also plays a more important role for older than for younger people.

Table 3: Linear regression analyses: Car use in total

Car as passenger	**Young (25-55)**				**Old (65-84)**			
(% of trips)	**Model 1**		**Model 2**		**Model 1**		**Model 2**	
	Beta	Sig.	Beta	Sig.	Beta	Sig.	Beta	Sig.
Age	.040	***	-.019	***	-.044	***	.030	**
Female	-.033	***	-.029	***	-.104	***	-.043	***
Handicaped	.006		.013	*	-.041	***	.048	***
Unemployed/retired	-.061	***	-.015	**	-.046	***	-.039	***
Household income	.019	***	.007		.002		-.011	
Single household	-.091	***	.018	**	-.173	***	-.016	
Single parent	-.002		.032	***				
Couple with kids	.077	***	.017	**				
Large urban	-.193	***	-.111	***	-.074	***	-.027	**
Rural	.032	***	.024	***	.048	***	.039	***
Distance to nearest station	.089	***	.062	***	.053	***	.031	**
Car(s) in household			.426	***			.415	***
Driving licence							.073	***
R^2	.106		.241		.088		.236	
adjusted R^2	.106		.240		.087		.235	

4 CONCLUSIONS

This study focussed on the possible effects that changing household forms, aging populations, and urbanisation have on future car use. Special attention was paid to living in a single person household (in different age groups) and being single parent as compared to more traditional household forms. We further looked into the effects of gender and urban form. The results show that the household form people live in has a distinct effect on their car use. Living in a couple household with kids is associated with higher overall car use. For many people having kids results in high perceived necessities to be mobile, and they highly appreciate the flexibility a car offers to cope with the complex requirements of managing and balancing family and working life (Haustein & Hunecke, 2007). While single parents might face at least similar challenges as couples with kids, we find a negative association with car use for them. This can, however, be explained by their lower car availability – when this factors is controlled for, the impact of being a single parent on car use as driver is even stronger than for living in a couple with kids. This may, on the one hand, indicate that single parents have the same needs (or wishes) to use a car but cannot afford it – pointing towards equity problems. On the other hand, single parents might be more willing or better able to manage their everyday life without a car and could thus serve as a positive example for car-free living. As this study is restricted to the data collected by the NTS, it cannot be answered in how far single parents face greater

mobility problems or have better coping strategies without a car compared to couples with kids. This is, however, an interesting future research question as both possibilities require different needs for action on a policy level.

Also persons in single households use the car less often, which is again associated with lower car ownership. For singles one can, however, assume that they have a lower car demand. In case the number of single person households and the number of single parent households keeps growing, this trend would point to a decreasing overall car use – as long as owning a car remains comparably expensive in Denmark and the average number of cars in the household remains unchanged.

The ongoing urbanisation also points towards decreasing car use. People in large urban areas use the car less often, even when car ownership is controlled for. This association is, however, less clear for older people (cf. Figueroa et al., 2014). For older people car ownership and car use as driver is most strongly associated with living with a partner. Living in large urban areas, however, has a strong impact on their car use as passenger – partly because older people in urban areas less often own a car – but probably especially because they are more likely to have a driver outside the household context available when they live in urban areas. It seems that living in an urban area, which offers better transport alternatives to a car, can satisfactorily compensate for the possibility to drive for young and middle aged people but not for older people, who are in that case more dependent on someone who gives them a lift. This is supported by a recent study showing that better access to alternative transport modes cannot sufficiently compensate for older peoples' mobility problems caused by lacking the option to drive (Haustein & Siren, 2014).

Older Danes today keep their license longer than earlier generations and have stronger intentions to keep driving in advanced age (Siren & Haustein, 2014b). One could additionally expect a growing car use of older people through the increasing licensing rates of older women. However, we actually find that gender differences with regard to car use – especially with regard to being driver or passenger – are not only pronounced in the population of older people but also for people in the family phase. This indicates that gender differences in car use do not disappear automatically with an adaptation of licensing rates. To what extent these differences are related to different gender roles and/or different travel preferences remains unclear. As driving experience is negatively associated with accident involvement (e.g. Maycock et al., 1991) and premature driving cessation (e.g. Haustein & Siren, 2014b), women should, however, be encouraged to choose the driving seat more often when travelling by car.

5 REFERENCES

Ahern, A., & Hine, J. (2012). Rural transport – Valuing the mobility of older people. Research in Transportation Economics, 34(1), 27–34.

Chlond, B. & Ottmann, P. (2007). Das Mobilitätsverhalten Alleinerziehender und ihre Aktivitäten außer Haus. Deutsche Zeitschrift für Kommunalwissenschaften, 46, 49–61.

Christiansen, H. (2012). Documentation of the Danish National Travel Survey. Lyngby, Department of Transport, Technical University of Denmark.

Christiansen, H., & Haunstrup, B. (2011). The Danish National Travel Survey—Declaration of Variables. Lyngby, Department of Transport, Technical University of Denmark.

Danmarks Statistik (2011). StatBank Denmark, http://www.statistikbanken.dk/statbank5a/default.asp?w=1280

Danmarks Statistik (2012). Størst Befolkningsvækst i København by, Befolkningsfremskrivninger 2012-2050, Nyt fra Danmarks Statistik, Nr. 231.

Danmarks Statistik (2013). Færre teenagere bor med far og mor. Nyt fra Danmarks Statistik 182.

Eriksson, L., & Westin, K. (2003). När går sista bussen? Glesbygdsbors uppfattning om värdet av kollektivtrafik. Rapport 2003:01. Umeå: Umeå university, Transportforskningsenheten.

Evans, E. L. (2001). Influences on mobility among non-driving older Americans. Transportation Research Circular E-C026, 151–168.

Figueroa, M.J., Nielsen, T.A.S., & Siren, A. (2014). Comparing urban form correlations of the travel patterns of older and younger adults, Transport Policy 35, 10–20.

Haustein, S. (2006). Mobilitätsverhalten in Abhängigkeit von der partnerschaftlichen Lebensform. Umweltpsychologie, 10(2), 160–182.

Haustein, S. (2012). Mobility behavior of the elderly – An attitude-based segmentation approach for a heterogeneous target group. Transportation, 39(6), 1079–1103.

Haustein, S., & Hunecke, M. (2007). Reduced use of environmentally friendly modes of transportation caused by perceived mobility necessities: An extension of the Theory of Planned Behavior. Journal of Applied Social Psychology, 37(8),1856–1883.

Haustein, S., & Siren, A. (2014). Seniors' unmet mobility needs – how important is a driving licence? Journal of Transport Geography. Accepted for publication.

Haustein, S., Siren, A., Framke E., Pokrieke, E., Alauzet, A, Marin-Lamellet, C., Armoogum, J., & O'Neill, D. (2013). Demographic change and transport. WP1 report of the EU project Consol. http://orbit.dtu.dk/ws/files/53288972/CONSOL%20Report_WP1_final.pdf

Hjorthol, R. (2013). Transport resources, mobility and unmet transport needs in old age. Ageing and Society, 33(7), 1190–1211.

INFAS & DLR (2010). Mobilität in Deutschland 2008, Ergebnisbericht. Bericht im Auftrag des Bundeministeriums für Verkehr, Bau und Stadtentwicklung. Bonn & Berlin, Germany.

Kunert, U. (1994). Singles: Zahlreich und mobil. Zum Mobilitätsverhalten alleinlebender Personen. In: S. Gräbe (Ed.), Lebensform Einpersonenhaushalt: Herausforderungen an Wirtschaft, Gesellschaft und Politik (pp. 133–158). Frankfurt a. M.: Campus.

Maycock, G., Lockwood, C. R., & Lester, J. F. (1991). The accident liability of car drivers. TRRL Research Report 315. Transport and Road Research Laboratory, Crowthorne, Berkshire.

Scheiner, J. (2006). Does the car make elderly people happy and mobile? Settlement structures, car availability and leisure mobility of the elderly. European Journal of Transport and Infrastructure Research, 2, 151–172.

Schwanen, T., Dijst, M., & Dieleman, F. M. (2001). Leisure trips of senior citizens: determinants of modal choice. Tijdschrift voor Economische en Sociale Geografie, 92(3), 347–360.

Siren, A., & Hakamies-Blomqvist, L. (2004). Private car as the grand equaliser? Demographic factors and mobility in Finnish men and women aged 65+. Transportation Research Part F: Traffic Psychology and Behaviour, 7(2), 107–118.

Siren, A., & Haustein, S. (2013). Baby boomers' mobility patterns and preferences: What are the implications for future transport? Transport Policy, 29, 136–144.

Siren, A., & Haustein, S. (2014a). What are the impacts of giving up the driving licence? Ageing and Society, published online June, 24, DOI: http://dx.doi.org/10.1017/S0144686X14000610

Siren, A., & Haustein, S. (2014b). Driving Cessation Anno 2010: Which older drivers give up their license and why? Evidence from Denmark. Journal of Applied Gerontology, published online February 12, DOI: http://dx.doi.org/10.1177/0733464814521690